



Contents lists available at ScienceDirect

Journal of Pediatric Nursing

journal homepage: www.pediatricnursing.org

Psychological aspects of pre-adolescents or adolescents with precocious puberty: A systematic review

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ARTICLE INFO

Article history:

Received 25 October 2021

Revised 4 January 2022

Accepted 4 January 2022

Available online xxxx

Keywords:

Precocious puberty

Pediatrics

Systematic review

Risk factors

Protection factors

ABSTRACT

Problem: Precocious puberty (PP) is an illness that appears when puberty, begins some years earlier than usual, provoking inferences in preadolescents and adolescents and their families. Therefore, the aim is to analyze if psychological consequences can be observed in groups of preadolescents or adolescents with PP.

Method: A bibliographic search of the scientific literature was made following the PRISMA guide in the following databases: ProQuest, Psychinfo, Web Of Science, and Scopus. 592 studies were found, were uploaded to Covidence to make a screening, of which finally 6 were included for the revision according to the inclusion and exclusion criteria. Two independent evaluators made the search, selection, data extraction and quality evaluation of studies independently. The agreement degree between both was excellent in all of the cases.

Results: 211 preadolescents participated in total in all studies, of which 99 were preadolescents with PP, with a mean age of 8,94 years old. Studies evaluated so heterogeneous variables, such as psychopathology, self-image, neuropsychological and cognitive variables, and reasons to delay or stop PP. The quality of studies was moderated especially due to the low quality of the studies design, which were mostly transversal, and the representativity of the sample, being selected by convenience.

Conclusions and implications: More research is needed to evaluate the psychological consequences of the PP diagnosis in pediatrics, and its protection factors, because none of the studies approached this question. We consider that it is necessary to increment the quality of these studies, and that these take a biopsychosocial perspective.

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Introduction

Puberty is the process that leads to sexual maturity or fertility (Lucaccioni et al., 2020), leading to the onset of pre-adolescence and adolescence. The major pubertal changes usually appear from age 8 to 14, occurring at age 10 (typically after age 8 for girls and age 9 for boys), although this range is very broad and may vary culturally (Papalia & Martorell, 2017). However, the average age at which puberty begins has decreased (Parent et al., 2003).

Precocious puberty (PP), on the other hand, is the gradual appearance of pubertal signs at an age less than 2.5 standard deviations below the average of a population. In Europe, PP is considered when the appearance of these characteristics occurs before the age of 8 in females (Avnon et al., 2019), and 9 in males (Pagani et al., 2020). PP can be divided into central precocious puberty (CPP) (98% of cases) or peripheral precocious puberty (2% of cases), depending on whether the causes are originated in the central or peripheral nervous system (Mejía de Beldejenna, 2015; Sociedad Española de Ginecología y Obstetricia, 2014).

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PP includes early breast and genital development as well as accelerated physical growth and bone age (Prété et al., 2008). In addition, negative physical changes, such as short stature, appear due to premature closure of growth plates (Kim & Lee, 2012). The number of women affected by PP is 29/100,000 women (with a ratio of women to men of 20:1). It is estimated that the global prevalence is 3.5/100,000 cases per year (Keshavan et al., 2014).

The appearance of a disease or a significant physical alteration at this stage can mean added stress, generating the need for adaptation in many areas of life and the deployment of personal resources to cope with these new vital conditions (Casaña-Granell et al., 2021a; Lucaccioni et al., 2020). Pre-teens and teens with PP often have greater psychological difficulties than their non-PP peers, especially due to adjustment problems and unexpected and unusual speed of change (Alcalá & Marván, 2014). These studies point to potential significant psychosocial challenges in children with PP (Casaña-Granell et al., 2021b; Kim & Lee, 2012).

The increase in PP incidence data has led to significant interest in studying these patients and their psychosocial impact. Therefore, the aim of the present research is to explore the psychological consequences present in pre-adolescents or adolescents with PP, through a systematic review.

Method

This qualitative systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standard (Shamseer et al., 2015).

Bibliography search

The ProQuest Central, Psychinfo, Web Of Science and Scopus databases were consulted by two independent authors (MLM, LLT) for relevant records published up to 30 January 2020. Based on the PICO approach (Mamédio et al., 2007), the following question was asked: Is there more impact in psychological aspects in pre-adolescents or adolescents (9–19 years old) diagnosed with PP comparing them to the control group (active or inactive one, when it exists)?

The final search combined the proposed key elements. The following Boolean (using MeSH terms) expression was therefore used in ProQuest, Psychinfo and Scopus: ((adolescen*) AND (early puberty OR precocious puberty) AND (psychol*)) and in Web of Science, the following: TS = (precocious puberty or early puberty AND adolescen* AND psychol*).

All the recovered items were uploaded to Covidence (Covidence systematic review software, 2018), the online screening and data extraction tool. Duplicated articles were eliminated, after that, two authors (MLM and LLT) reviewed the titles and abstracts of all the papers and excluded the articles that did not meet the inclusion criteria based on reading the title and abstract. The articles that were selected by either of the two authors, or which contained differences between their blinded decisions, were read in depth individually and blinded, and re-evaluated to judge their eligibility according to the inclusion and exclusion criteria. The same authors (MLM and LLT) inspected the reference lists of the selected studies to assess the inclusion of quality references that had not appeared in the initial searches. Handsearching followed a snowball sampling procedure to identify relevant articles in the reference lists of potentially useful documentation. Finally, disagreements between the two authors were resolved by discussion.

Cohen's Kappa (κ) (Orwin, 1994) was used to assess the index of inter-judge agreement, taking into account that values between -1 and 0.40 are considered unsatisfactory, values between 0.41 and 0.75 are considered satisfactory and ≥ 0.76 are considered satisfactory (Hernández-Nieto, 2002). Fig. 1 shows the flow chart of the information used to answer the review question. Due to the highly heterogeneous nature of our results, and specifically the differences in the variables taken

into account and the instruments used to evaluate them, we did not consider it appropriate to perform a subsequent meta-analysis of these data, since they could not be combined.

Inclusion and exclusion criteria

Studies that met the following criteria were included in the present systematic review: (a) the study assessed psychological risk or protective factors in the presence, diagnosis or treatment of PP, (b) the average age of the participants was between 9 and 19 years old, (c) the study was published in journals with an impact factor, (d) the study was published in English or Spanish, (e) were published between 2015 and 2020. This temporal criterion was used because we wanted to have an updated view of the issue. Social, political, economic and health realities have changed enormously in recent years. In order to have an up-to-date view of the issue, we used the last five years.

As exclusion criteria, we suggested that the studies could not refer to: (a) people with other pathologies, (b) papers published in conferences, (c) narrative reviews, (d) single case designs, (e) articles that if they covered several pathologies, did not break down the results obtained for PP in detail, (f) or those that only analyzed the epidemiology or prevalence of the disease, and (h) the ones that did not focus on PP as the diagnosis, but in other varieties such as early menarche or premature adrenarche.

Quality assessment

Two authors (MLM and LLT) independently and blindly assessed the quality of the included studies using an adapted version of the Quality Assessment Tool for Quantitative Studies developed by the Effective Public Health Practice Project (Wermelinger Ávila et al., 2017). This tool consists of 19 items that assess 8 criteria: (a) study design, (b) representation, (c) representativeness – selection bias, (d) representativeness – withdrawals and dropouts, (e) confounders, (f) data collection methods, (g) data analysis, and (h) reporting. The rating for each criterion ranges from 1 (low risk of bias; strong) to 3 (high risk of bias; weak) (Table 1). Based on the study by (McMullan, Berle, Arnáez, & Starcevic, 2019), studies can have between 4 and 8 component ratings based on the 8 criteria. An overall rating is assessed according to the component ratings. For example, a study with 6 ratings could be rated as strong if there are no weak ratings and at least 3 strong ratings, moderate if there is one weak rating and less than 3 strong ratings, or weak if there are two or more weak ratings.

Data extraction

One author (MLM) developed a data extraction form that was used to obtain relevant information from the included studies. This information included the first author, year of publication, participants, variables and instruments, study design, main conclusions and quality assessment rating (Tables 2 and 3).

Results

Study selection and screening

The study selection process is shown in Fig. 1. After the literature search, the application of the time criterion and the elimination of duplicated results, the total number of records was 592. In the initial selection 542 studies were excluded based on the title and abstract, and the full text of the remaining 50 papers were read in a second selection process. The reliability of the prior agreement between the two independent reviewers (MLM and LLT) on the screening of the full text was excellent ($\kappa = 0.78$). 44 papers were excluded in the second screening and as such six independent studies were eligible for inclusion. The degree of

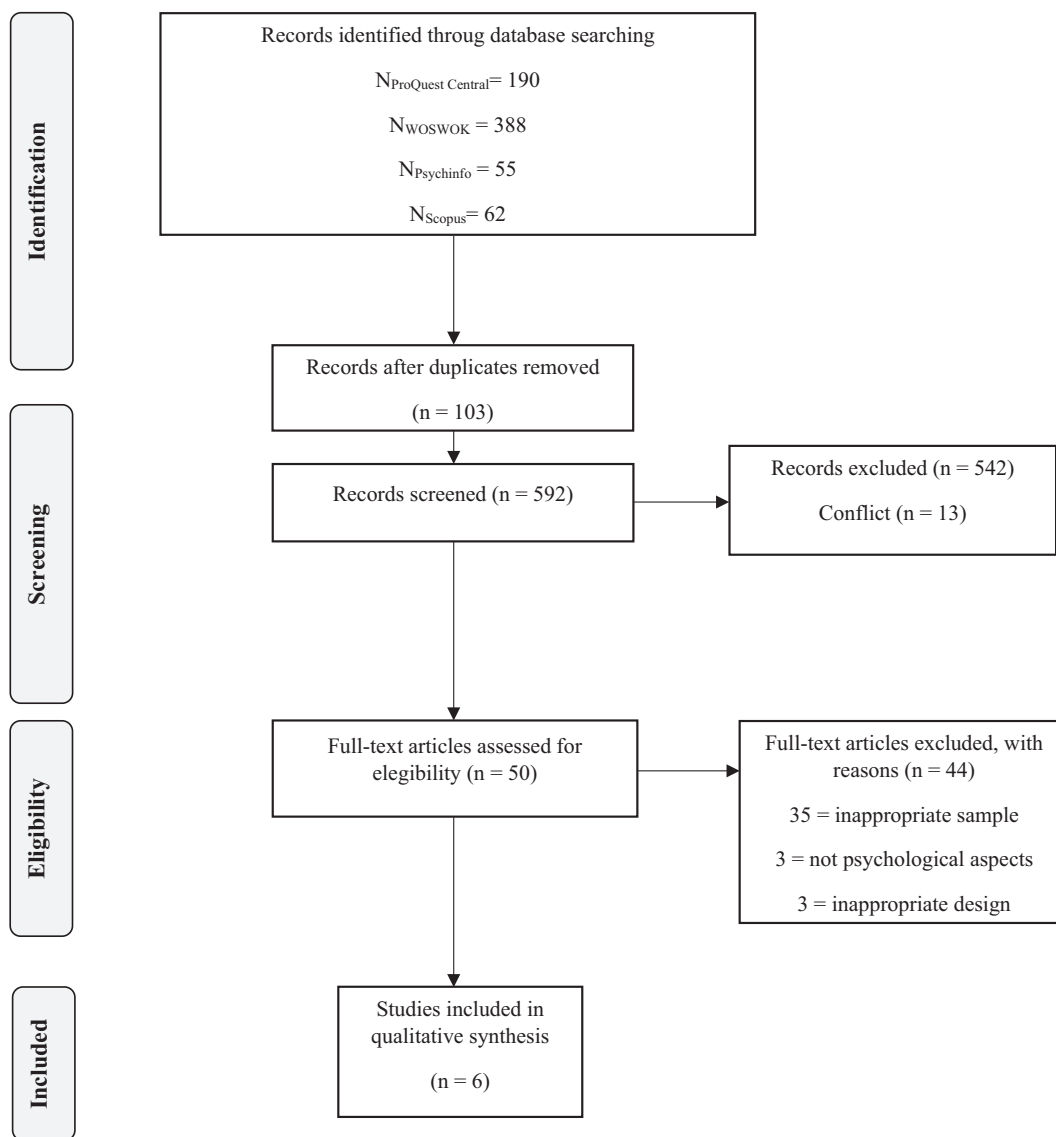


Fig. 1. Flowchart of selection process.

Table 1
Explanation of the scale for assessing the quality of the studies.

Item	Explanation
Study design	Study design refers to the type of study conducted (experimental, observational, cross-sectional or longitudinal studies).
Representativeness	Representativeness refers to the extent to which the work sample is generalisable to the population.
Representativeness II	Representativeness II refers to representativeness due to withdrawals and dropouts.
Confounding factors	Confounding refers to the control or assessment of relevant confounding factors in the analyses for the sample under study.
Data collection	Data collection refers to whether tools with adequate psychometric properties have been used in the work.
Data analysis	Data analysis refers to the methods used for data analysis (for example, only descriptive analyses versus more complex analyses).
Data reporting	Data reporting refers to the extent in which authors were specific in their reporting about hypotheses and probability
Overall rating	It is the average of the ratings of the previous items.

Note: Information extracted and expanded from Wermelinger Ávila et al. (2017).

inter-judge agreement was also excellent in this second screening ($\kappa = 0.94$).

Characteristics of the study

The characteristics of the study are summarized in Table 1. The six studies investigated included a total of 211 pediatric PP patients, all of them were women. The number of participants in the studies ranged from 10 to 62 ($M = 35.16$). Of these participants, 99 (46.91%) had a diagnosis of PP (*Deeb et al., 2018; *Menk et al., 2017; *Mercader-Yus et al., 2018; *Shoelwer et al., 2015; *Shoelwer et al., 2017; *Wojniusz et al., 2016). Among these, 10 (10.10% of the 99 participants with PP) also had a disability (*Deeb et al., 2018), and of the remainder, 17 (8.05%) did not have PP but did have a disability (*Deeb et al., 2018).

On the other hand, 30 (14.21%) had a diagnosis of premature adrenarache (*Shoelwer et al., 2015; *Shoelwer et al., 2017), 34 (16.11%) early normal puberty (*Shoelwer et al., 2015; *Shoelwer et al., 2017) and the remaining 31 (14.69%) were healthy, medically undiagnosed control groups which were compared to PP participants (*Menk et al., 2017; *Mercader-Yus et al., 2018; *Wojniusz et al., 2016). The average age of participants ranged from 6.60 to 10.40

Table 2
Summary of studies.

First Author and year	Design	Participants	Evaluated variables	Main contribution
Schoelwer 2015	Descriptive, non-experimental, cross-sectional	62 pre-adolescent women aged 6–9 ($M = 7.50 \pm 1.40$): 19 with central precocious puberty (CPP), 22 with premature adrenarche (PA), and 21 with normal early puberty (ENP), and their mothers.	<ul style="list-style-type: none"> • Sociodemographic variables: age, language and origin. • Clinical variables: BMI, age of onset of puberty, biochemical confirmation of activation of the HPG (LH) axis, (clinical and radiographic evidence), possibility of previous treatment with GnRHα, and developmental delay. • Psychological variables of pre-adolescents: depressive symptoms, congenital competition, peer acceptance, physical competition, and maternal acceptance • Mothers responded about their daughters about: behavioral and emotional problems, personality, depression, anxiety and stress, emotionality. • About the mothers, the following were evaluated: personality, anxiety, depression and stress, and affectivity. 	<ul style="list-style-type: none"> • Adolescents with CPP, PA and ENP do not differ in depressive symptoms, in levels of cognitive skills, peer acceptance, physical competence and maternal acceptance, nor in internalizing, externalizing problems. • Mothers of adolescents with PA have greater depression and stress than mothers of adolescents with CPP, and the latter scored higher than mothers of adolescents with ENP.
Wojniusz 2016	Descriptive, non-experimental, cross-sectional	30 pre-adolescent women: 15 with CPP between 9.20 and 11.80 years old and 15 controls between 9.10 and 11.40 years old, as well as their parents.	<ul style="list-style-type: none"> • Sociodemographic variables: age, origin and training and profession of parents. • Clinical variables: initiation of breast development, LHRH test, duration of GnRHα treatment (physical examination, blood sample, GnRHα test), Tanner's status, growth rate and bone age (clinical and radiographic tests, X-rays and Greulich & Pyle method, 1959), possibility of any other chronic disease, cognitive or behavioral problems or learning difficulties, and heart rate (HRV). • Psychological variables (assessed in pre-adolescents): intellectual capacity, auditory-verbal memory, with the components immediate memory, long-term memory, learning rate, spatial skills, executive functions and processing speed, attention, emotional reactivity. • Psychological variables (assessed in pre-adolescents through their parents): short and long-term memory, executive functions, attention, cognitive difficulties, emotional regulation, academic and social competence, behavioral problems, personality, somatic complaints and anxiety/depression. 	<ul style="list-style-type: none"> • Participants with CPP have a slower heart rate associated with the duration of treatment, and a higher HRV. • They have slower processing speed, but greater emotional reactivity, than those in the control group. • Finally, according to family reports, the groups present similar values in: cognitive, behavioral, executive functions, academic and social competence.
Menk 2017	Observational, longitudinal.	10 pre-adolescent women diagnosed with CPP, age $M = 8.00 \pm 1.10$ years old in the first clinical and psychological evaluation, and $M = 9.30 \pm 1.30$ years old in the second evaluation.	<ul style="list-style-type: none"> • Sociodemographic variables: age of onset of pubertal changes, age before and during treatment, height, and weight. • Clinical variables: pubertal status, Tanner status (breast development and pubic hair), growth rate, bone age (Greulich & Pyle method, 1959), LH, FSH and estradiol levels (by ultra-sensitive electrochemiluminescence assay), central nervous system (MRI) and duration of treatment • Psychological variables: stress levels (physical, psychological, psychological components with a depressive component, and psychophysiological reactions) All evaluated in: state of alarm, resistance, near exhaustion, and burnout. 	<ul style="list-style-type: none"> • CPP is a stressful condition for pre-teens. • Medical treatment reduces stress levels, in the physical, psychological, and psychological components with a depressive component, but not in the psychophysiological components.
Schoelwer 2017	Descriptive, non-experimental, longitudinal	36 pre-adolescent women aged 6–11 at the first assessment, and 7–12 at the second assessment. 15 with CPP, 8 with PA and 13 with ENP, and their mothers.	<ul style="list-style-type: none"> • Sociodemographic variables: age, language and origin. • Clinical variables: BMI, time of onset of puberty (biochemical confirmation of activation of the HPG axis), clinical, radiographic and biochemical characteristics, if they had been treated previously, and developmental delay. • Psychological variables (assessed in pre-adolescents): depression, cognitive 	<ul style="list-style-type: none"> • Adolescent girls with PP, PA and ENP achieve the same levels of depressive symptoms, cognitive competence and peer acceptance. • After one year of follow-up (and in the case of participants with PP after one year of GnRHα treatment), there is a decrease in perceived physical competence and an increase in perceived maternal acceptance.

Table 2 (continued)

First Author and year	Design	Participants	Evaluated variables	Main contribution
Mercader-Yus 2018	Descriptive, non-experimental, cross-sectional.	31 pre-adolescent women aged 8 to 12. 15 with precocious puberty (PP) (46.70% with pubarchy, 33.30% with telarchy, and 20.00% with advanced puberty), 16 without diagnosis.	<ul style="list-style-type: none"> competence, physical competence, peer acceptance, and maternal acceptance, behavioral and emotional problems Psychological variables (assessed in mothers): personality, depression, anxiety and stress, and emotionality Sociodemographic variables: age, date and place of birth, grade, school, diagnosis, time since diagnosis, pharmacological treatment and duration of treatment in the group with PP (by means of an interview created ad hoc). Psychological variables: anxiety, self-esteem and body image. 	<ul style="list-style-type: none"> Negative maternal affect increases after one year of follow-up, in all three groups of participants, CPP, AP and ENP, but positive affect does not. There are also no differences in personality, depression, anxiety or stress. Preteens with PP have greater anxiety and lower body image than preteens without PP. But they do not differ in self-esteem.
Deeb 2018	Non-experimental, qualitative and transversal.	42 preteen women and their mothers. 15 CPP and without disability (group A), from 7.00 to 13.00 years old, 10 with CPP and disability (group B1) from 5.00 to 11.10 years old, and 17 with habitual puberty and disability (group B2), from 10.30 to 14.00 years old.	<ul style="list-style-type: none"> Socio-demographic variables: age and place of origin Clinical variables: duration of GnRHa treatment, medical conditions derived from CPP in the disabled groups, age of presentation of puberty, initial signs of puberty, results of initial biochemical and radiological tests (electronic medical records). Psychological variables: reasons why mothers wanted to stop their daughters' puberty and whether they would use surgery to do so. 	<ul style="list-style-type: none"> Mothers' main reasons for delaying or stopping puberty for Group A participants are: fear of short stature, and rejection by peers. For mothers group A and B is the inability to cope with the psychological changes of puberty. Reasons for mothers of preadolescents with disabilities are: inability to express menstrual pain well, difficulty in seeking help from a male family member, effects of seizures, and breast pain from the wheelchair.

(M = 8.94). 66% of the studies included also data from mothers of pre-adolescents with PP and only one study included fathers' data too.

Sample selection and research desing

With regard to the sample, 33.33% (n = 2) of the studies did not specify the form of selection of participants (*Menk et al., 2017; *Shoelwer et al., 2017), 66.66% (n = 4) had a purposeful selection (*Deeb et al., 2018; *Mercader-Yus et al., 2018; *Shoelwer et al., 2015; *Wojniusz et al., 2016). In one of the studies reviewed (16.66%, n = 1), the selection of PP participants was purposeful, however, the preadolescents without a diagnosis of PP who participated were enrolled through pamphlets distributed in public places (*Wojniusz et al., 2016). Only two studies (33.33%, n = 2) were longitudinal, with two evaluations (one before and one during or after the intervention). In these longitudinal studies, the average evaluation time was 1.10 years, with a range of 1 to 1.20 years between evaluations (*Menk et al., 2017; *Shoelwer et al., 2017).

Representativity

In reference to the representativeness of the sample for treatment abandonment in the longitudinal studies: in one of them, there was no abandonment or rejection of the participants (*Menk et al., 2017), in the other one, the abandonment rate was 42%, due to the difficulty

of contacting the participants and their mothers (*Shoelwer et al., 2017).

Variables

The independent and dependent psychological variables evaluated were very heterogeneous. Among the aspects analyzed in pre-adolescents and adolescents with PP were psychopathology, stress, self-esteem, body image, cognitive functioning, social relationships, maternal acceptance. In the main family caregivers, the following were evaluated in particular: psychopathology, personality, present emotions and the reasons they had for wanting to delay or stop their daughters' puberty. Instruments with adequate psychometric properties and well-adjusted to the topic, goal and use made, as well as semi-structured interviews created ad hoc to complement the data were used. The medical variables can be seen in Table 1.

Inclusion and exclusion criteria

Four of the studies (66.66%) specified their inclusion criteria. Of the remaining articles, one (*Deeb et al., 2018) did not add inclusion or exclusion criteria, another one did not mention inclusion criteria (*Menk et al., 2017). Four studies added the specific age at the time of the study, or at the time of PP onset (5–12 years), and also the evidence of the diagnosis of the disease (*Mercader-Yus et al., 2018; *Shoelwer

Table 3 Article quality assessment.

First author	Study design	Representation	Representation II	Confounding factors	Data collection	Data analysis	Data reporting	Overall rating
Schoelwer	4	2	N/A (do not follow up)	1	1	1	1	Moderated
Wojniusz	4	2	N/A (do not follow up)	2	1	1	1	Moderated
Menk	2	5	1	2	1	2	1	Moderated
Schoelwer	2	5	3	2	1	1	1	Moderated
Mercader-Yus	4	3	N/A (do not follow up)	3	1	2	1	Moderated
Deeb	4	2	N/A (do not follow up)	2	4	4	1	Moderated

et al., 2015; *Shoelwer et al., 2017; *Wojniusz et al., 2016). In addition, one study included as an analysis variable the fact of having been under GnRHa treatment for 6 months and having had a clinical follow-up of 2–3 months (*Wojniusz et al., 2016). In addition, inclusion criteria of two articles were respondents had to be English speaking (*Shoelwer et al., 2015; *Shoelwer et al., 2017).

Those participants who: a) had been in treatment with GnRHa before; b) those who made cooperation in the intervention difficult due to the presence of other physical or mental illnesses; and c) those of non-European origin, due to cultural differences in the onset of puberty, were excluded (*Mercader-Yus et al., 2018; *Wojniusz et al., 2016).

Main results of the psychological variables

Pre-adolescents and adolescents with PP showed more anxiety and poorer body image than the pre-adolescents and adolescents without PP examined (*Mercader-Yus et al., 2018). Participants with CPP were found to have less stress, but less perceived physical competence. In addition, they had lower maternal acceptance after medical treatment (*Menk et al., 2017), with their mothers showing more negative affect (*Shoelwer et al., 2017).

In reference to neuropsychological variables: emotional reactivity and heart rate variability (HRV) were higher in pre-adolescents and adolescents with CPP than in those without CPP. In contrast, heart rate and the measure of information processing speed were lower (*Wojniusz et al., 2016).

A large proportion (80%) of the mothers of pre-adolescents and adolescents with PP felt rejected and afraid of their daughters' advanced puberty. Reasons for this would include the psychological consequences that their daughters may suffer from this condition. At this point, there are differences in the motivation referred to in the mothers of pre-adolescents and adolescents with PP and disability, with the latter noting that the reasons for this rejection were associated with disability (Table 1).

Quality assessment

Table 2 shows the ratings obtained by the articles analyzed, after the evaluation of their quality indicators using PRISMA standards of study quality was conducted by one of the evaluators (MLM). The quality scores range from 1 to 5 (most likely to be biased or lowest quality). The mean quality score was 2.15, i.e. a moderate total score across all studies (Table 2).

Discussion

The aim of this study is to determine whether there is more psychological impairment in pre-adolescents or adolescents (9–19 years old) diagnosed with PP by comparing them to the control group (active or inactive one, when it exists, using a systematic review using PRISMA standards. After an exhaustive search, few studies were obtained that met the specified inclusion and exclusion criteria, with six studies finally analyzed. These studies have been especially focused on assessing the role of risk factors such as: anxiety and depression, low self-esteem, alterations in body image and behaviour, and impaired cognitive abilities.

Firstly, comparing pre-adolescents and adolescents with PP to their peers without this problem, young women with PP show poorer emotional regulation (*Mercader-Yus et al., 2018; *Wojniusz et al., 2016). In addition, they show high levels of anxiety, emotionality and body image impairment. This information is consistent with the literature that points out how emotional regulation problems are key in the development and maintenance of emotional and behavioral problems (Schoeps et al., 2019). This is in line with previous studies that have highlighted that girls with PP (as opposed to girls experiencing physical pubertal changes at a normative age) usually have more anxiety,

excessive emotionality, body image problems and isolation (Casaña-Granell et al., 2021a; Kim & Lee, 2012). However, it is possible that women with PP show more depressive symptoms than women without PP, but the difference with women with early adrenarche is not clear (*Shoelwer et al., 2015). These results point to the importance of further research on the differential effect that these conditions have on the level of suffering of young women.

In relation to the longitudinal studies that evaluate the effects of the application of GnRHa treatment in patients with CPP, early adrenarche and early normal puberty, it is observed that patients with CPP present lower levels of stress after treatment than controls without these problems (*Menk et al., 2017). However, at the same time a decrease in perceived physical competence appears in participants with CPP, PA and ENP after treatment (*Shoelwer et al., 2017).

On the other hand, regarding primary caregivers, our results based on the analysis of the four studies included in our work, point out that: mothers of pre-adolescents and adolescents with PP present high levels of anxiety, and this may be a faithful reflection of the psychological burden that living with a pre-adolescent or adolescent daughter with PP may entail. In this regard, an important aspect to note is how most of these mothers wanted to stop their daughters' puberty through medical treatment because they were afraid of it (*Deeb et al., 2018). Accordingly, when young women with CPP were undergoing medical treatment, their mothers showed greater negative affect after treatment (*Shoelwer et al., 2017). This finding seems counterintuitive; however, we think that it could be due to the stress that these caregivers would experience in addition to the stress of raising a pre-adolescent or adolescent (Casaña-Granell, Lacomba-Trejo, Montoya-Castilla, & Pérez-Marín, 2021a; Lacomba-Trejo, Casaña-Granell, Pérez-Marín, & Montoya-Castilla, 2017). Despite the above result, it should be noted that after treatment, these mothers showed greater acceptance towards their daughters (*Shoelwer et al., 2017). This aspect could significantly contribute to the improvement of the mental health of pre-adolescents and adolescents after the intervention, since personal image is created and maintained, based, in part, on the vision of parents and peers (Sánchez-Queija et al., 2016).

Practice implications

The results of our work can help to understand in more detail the effects of PP on pre-adolescent and adolescent girls. Health professionals can be sensitised to the importance of considering psychosocial aspects of the disease. Nursing professionals can identify adolescent girls in need of psychological intervention. In this way, future complications can be prevented.

Limitations

Despite the contributions of the systematic review work carried out by us, it should be noted that the search strategy wasn't developed by a librarian. In addition, the studies that met the inclusion criteria had small and inhomogeneous samples, ranging from 10 to 25 participants with PP (*Deeb et al., 2018; *Menk et al., 2017), and had total samples of 10 to 62 participants (if all the pre-adolescents and adolescents who participated are considered, regardless of their condition) (*Menk et al., 2017; *Shoelwer et al., 2015). In addition, all participants with PP are female, so there are no studies examining the psychological consequences of early puberty in males. This gendered aspect should be considered in future research. However, these data reflect the reality of PP, which is much more common in females than males (Keshavan et al., 2014).

In most of the studies analyzed, the selection of participants was done for convenience (*Deeb et al., 2018; *Mercader-Yus et al., 2018; *Shoelwer et al., 2015; *Wojniusz et al., 2016) and in the rest of the studies, the sample selection method is not mentioned (*Menk et al., 2017; *Shoelwer et al., 2017). Therefore, we consider that the characteristics of

the sample and the sampling carried out in these studies complicate the generalization of the results to the general population. More studies are needed that continue to investigate the reality of pre-adolescents and adolescents with PP, with probability sampling that represents the characteristics and peculiarities of these young women. However, we must bear in mind that, in this type of study carried out in hospital settings, the final samples obtained are usually small due to the difficulty of accessing patient data, even more so if they are from children or adolescents.

In addition to the above, most of the selected studies use very heterogeneous variables in the analysis, perform descriptive analyses and use cross-sectional designs. These aspects complicate the generalisability of the results and the performance of a meta-analysis, which would be desirable in the future, as they would favour knowledge of factors related to prevention, the appearance and maintenance of difficulties in these patients and their carers. However, four studies include the primary caregivers of the participants in the sample (*Deeb et al., 2018; *Shoelwer et al., 2015; *Shoelwer et al., 2017; *Wojnusz et al., 2016), thus providing data from multiple informants, which may reduce the errors made in self-reports. The caregivers included were generally mothers. Therefore, we consider that future research should also try to access parents in order to reach a better understanding of the phenomenon of childcare in this situation. However, our study reflects the usual reality of care in families, the primary family caregiver is usually the mother, especially in paediatrics (Casaña-Granell, Lacomba-Trejo, Valero-Moreno, Pérez-Marín, & Montoya-Castilla, 2018). Finally, of the selected studies, only one was conducted in the Spanish population (*Mercader-Yus et al., 2018). Therefore, we believe that work is still needed to clarify the

effects of these patients in order to develop intervention strategies specifically aimed at this group in our context.

Systematic review in PP is very scarce, even more so those focused on possible psychological consequences in pre-adolescents and adolescents with PP. As a result of a systematic search of the literature based on precise and systematic inclusion criteria, this review extends knowledge beyond the conclusions of narrative reviews. In addition, our review included two blinded evaluators throughout the process, as well as the index of agreement between them. Based on the results obtained, future research needs to evaluate psychological and medical aspects, considering a comprehensive and multidisciplinary approach to health from a biopsychosocial point of view. It is also necessary that this type of intervention be directed not only to the patient, but also to his or her family system.

Conclusion

The main results of our study point out that pre-adolescent and adolescent girls with PP show high levels of perceived depression, stress, anxiety, emotionality, and physical incompetence, as well as a large impairment of their body image and processing speed. In addition, high levels of worry and negative affect are observed in their primary family caregivers. The main findings indicate that PP can be a condition that impacts on the individual and his or her family. However, few studies have been carried out in this area and the quality of these studies is moderate. Further work of higher quality is needed to reach clearer conclusions. Nevertheless, it is necessary to stress the importance of taking preventive health measures in this population and establish appropriate psychological actions in cases that require them.

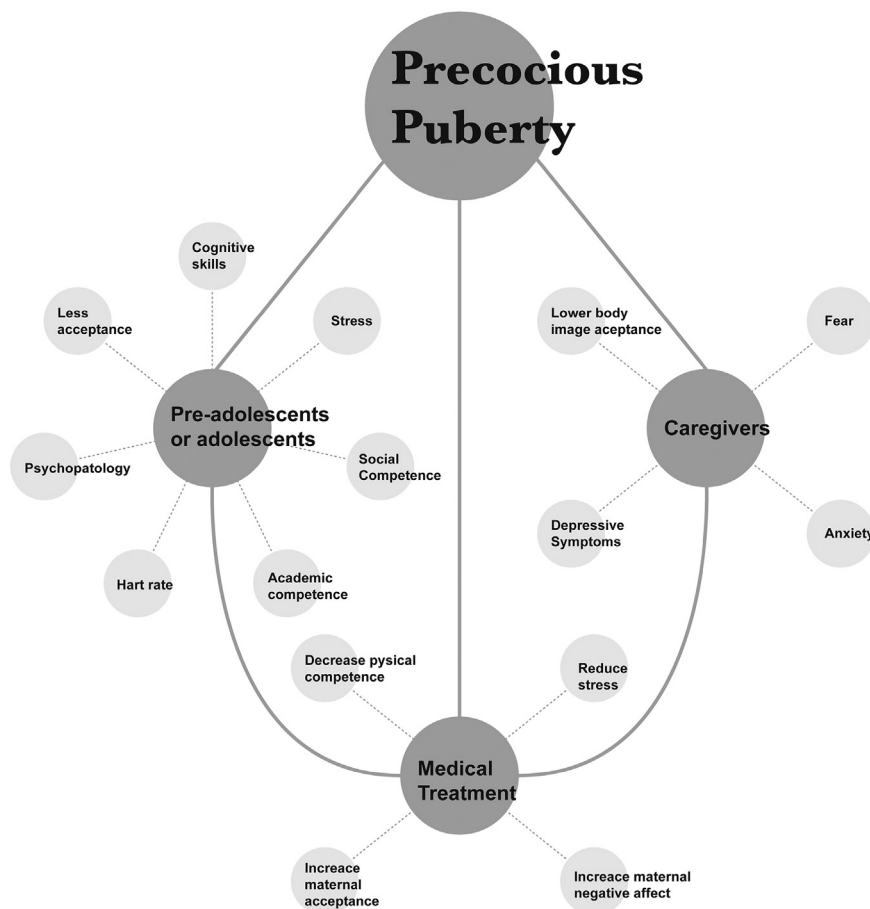


Fig. 2. Summary of the main results.

Funding

This study has been financed by: a) Training aid for pre-doctoral research staff "Atracció de Talent" of the Universitat de València (0113/2018).

Declaration of Competing Interest

None. All authors declare that they have no conflicts of interest.

Acknowledgments

We thank Lourdes Gimeno Lorente, graphic designer, for her help with the design of Fig. 2 of this manuscript.

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